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ABSTRACT

Iowa State University, through a program called Project BIO (Biology Instructional Outreach), has been using RealAudio technology for about 2 years in college biology courses that are offered entirely via the World Wide Web. RealAudio is a type of streaming media technology that can be used to deliver audio content and a variety of other media types via the Internet. Project BIO is a multifaceted outreach project with the vision of developing and sharing biology education resources via the Internet. A major objective of Project BIO is to develop and teach online biology courses via the World Wide Web. Most of the courses have been adapted from existing Iowa State University courses that are also offered in a traditional face-to-face format. The Project BIO courses account for about 20% of the online biology courses offered in the United States. This paper discusses the instructional design; production of online lectures; enrollment and audiences for Project BIO online courses; and assessment of the courses. Project BIO online courses for the fall 1998 semester are listed, and a table showing the growth of the program from 1996-1998 is included. (AEF)

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Development and Assessment of Web Courses That Use Streaming Audio and Video Technologies

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Introduction

Iowa State University, through a program called Project BIO, has been using RealAudio™ technology for about two years in college biology courses that are offered entirely via the World Wide Web. RealAudio™ is a type of streaming media technology that can be used to deliver audio content via the Internet. Streaming media technology can also be used to deliver a variety of other media types (video, animation, text and static images) via the Internet. Using this technology, media files are broken into packets on the server side and streamed over the Internet. On the client or user side, the packets are reassembled on the fly and played using a "plug-in" or helper application for a Web browser. The practical effect is that the media content can be heard or viewed almost instantaneously by the user and the amount of content that can be delivered is virtually unlimited. The technology can be used in either an on-demand mode or a broadcast mode. The delivery of Web pages can be synchronized (automatically or manually) with the streaming media. RealAudio™ is a product of RealNetworks™ (http://www.real.com) the leading software company in this area.

Project BIO (Biology Instructional Outreach) is a multifaceted outreach project with the vision of developing and sharing biology education resources via the Internet. A major objective of Project BIO is to develop and teach on-line biology courses via the World Wide Web. The program has grown from two on-line courses offered during fall semester 1996 to ten on-line courses (8 biology plus 2 economics) that will be offered during fall semester 1998 (Table 1). Most of the courses have been adapted from existing Iowa State University courses that are also offered in a traditional face-to-face format. Project BIO is a national leader in developing on-line biology courses. The Project BIO courses account for about 20% of the on-line biology courses offered in the United States.[1] Project BIO on-line courses were among the first to utilized streaming media technology (i.e. RealAudio) for instruction.

Instructional Design

The on-line courses support multiple learning styles. Students learn by 1) seeing and hearing information presented in on-line lectures, 2) doing active learning assignments and 3) reading material in on-line resources or in the required textbook. The on-line lectures are modeled after a face-to-face lecture experience. Students listen to the instructor using RealAudio™ technology and view a series of slides containing bullet points, diagrams, photographs and other visual aids with a Web browser. The active learning assignments provide lab-like experiences, teach students to find and process information on the World

IR019000

Wide Web, foster interaction/collaboration among students and reinforce concepts presented in the lectures.

Table 1. Project BIO On-Line Courses—Fall Semester 1998

Introductory biology courses for majors	Advanced undergraduate and graduate courses
Audience: On-campus ISU students, high school students	Audience: High school and community college teachers, farmers, agribusiness professionals, health science professionals
Biol 201: Principles of Biology I	MIPM 302: Biology of Microorganisms
Biol 202: Principles of Biology II	Gen 308/508: Biotechnology in Agriculture, Food and Human Health
	MIPM 501X: Advanced Microbiology
Introductory biology courses for non-majors	**Introductory economics courses**
Audience: On-campus ISU students, high school students	Audience: On-campus ISU students, high school students
Biol 109: Introductory Biology	Econ 101: Principles of Microeconomics
Biol 123: Environmental Biology	Econ 102: Principles of Macroeconomics
Zool 155: Human Physiology and Anatomy	

Students access course materials using standard Internet technologies (Web browser and RealPlayer). RealPlayer software is used to access the audio portion of the lectures. The Web browser and RealPlayer software are available at no charge to students and are compatible with Mac, PC or UNIX systems. The bandwidth requirement for hearing and viewing the on-line lectures is modest (14.4 Kbps).

We are using ClassNet software to support student/student and student/instructor interaction via the Internet. This software supports three types of text-based communication. Two types are asynchronous (email and a discussion forum or bulletin board) and the other type is synchronous (chat). We are in the process of evaluating several types of advanced communications technologies. Some desirable features are audio communication, white board and browser following.

Assessment of student performance is based on periodic examinations during the courses and on the quality of work in the active learning assignments. Testing is done on-line using ClassNet software. Proctors are used to verify student identity and to monitor student conduct during the exams. The proctor must enter a special password before the student can access the on-line exam.

Production of On-Line Lectures

We have established a facility called the Digital Distance Education Resource Center to support on-line course development efforts. This facility has a server as well as server software for delivering Web and streaming media content. The facility also has two recording studios with all the necessary technology for recording, digitizing, editing and

formatting audio and video content. Finally the facility has four computers for general purpose Web authoring.

The Resource Center also has personnel to provide training, technical support and assistance with Web course development. In our approach, the instructor provides lecture outlines, visual aids and records the lectures. Undergraduate Assistants employed by the Resource Center perform the routine aspects of lecture production (e.g. converting the lecture outlines and visual aids to Web-based slides, editing audio files and formatting them for delivery via the Internet).

Enrollment and Audiences for Project BIO On-Line Courses

Enrollment in Project BIO on-line courses has grown from 29 students in Fall semester 1996 to 285 students in Spring semester 1998 (Table 2). Approximately 700 students have taken our courses through Spring semester 1998.

Table 2. Growth of the Project BIO On-Line Course Program

			Location of Students			
				Off-Campus		
Semester	Number of Courses	Number of Faculty	On-Campus	High School	Non-Traditional*	Totals
Fall 1996	2	2	9	0	20	29
Spring	4	4	60	71	14	145
Fall 1997	6	5	134	63	18	215
Spring	6	7	198	60	27	285
Fall 1998	10	8	—	—	—	—
Totals			401	194	79	674

*This group includes high school and community college biology teachers, agriculture and agribusiness professionals, health care professionals, government employees.

The on-line college courses developed through Project BIO serve three types of audiences: 1) high school juniors and seniors, 2) non-traditional students, and 3) on-campus ISU students (Tables 1 and 2).

High school juniors and seniors represent the major off-campus audience for our on-line courses. They are primarily taking introductory level courses although a few have taken advanced level undergraduate courses as well. Many of these students are from rural high schools that lack resources or sufficient student numbers to offer advanced courses for their brightest and best students. As an example only 1/3 of Iowa high schools offer advanced placement biology courses. Students in our on-line courses are able to "attend class" during

a free period at school or at home in the evenings. Additionally there is no minimum class size at a particular location.

Non-traditional students include high school and community college teachers, farmers, agribusiness employees, health care professionals, and government employees. Many of these individuals are place-bound and have schedule restrictions because of work and/or family that limit their access to college courses.

Surprisingly, the largest audience (60%) for the Project BIO on-line courses has been on-campus Iowa State University students. They have taken introductory level courses as well as courses at the advanced undergraduate or graduate level. In most cases they are taking the on-line courses instead of a comparable section of the course offered in a traditional face-to-face classroom setting. The attraction of these courses for this audience seems to be: the flexible scheduling which allows students to more easily fit these courses into their schedules, the ability for a student to work at his or her own pace, and the novelty of taking a course via the World Wide Web.

Assessment of the Courses

As with any technological advance, pedagogical questions surround its use in the classroom. In this case, the classroom has been replaced by an asynchronous, individual learning environment. While there appears to be anecdotal evidence that this type of instruction does not negatively affect the learning environment for the students, solid research was needed to substantiate these claims. Two separate approaches to this problem have been undertaken. The first approach was an in-depth analysis of the learning environment and its effects on students enrolled in the WWW section of Zoology 155. In order to provide a rich, thick description of this phenomenon, qualitative methods were used (Merriam 1988, Lincoln and Guba 1985). Three students were chosen from the Fall 1997 semester, and their experience as they traveled through the course was documented. These students were hand selected: one student was a close match to the "average" student in the traditional lecture; one was chosen from the adult student population, and the final case was a student identified as "at risk" by the University. Using data collected from journals, e-mail correspondence and formal interviews, the lived experience of these students was recorded (Greene 1973). While generalization is not a goal of qualitative research, certain themes did emerge with consistency across all three students. These included:

- The technology is problematic for some, particularly females. Confidence in the technology and in the user is important to a positive experience with the Web-class. Two of the cases followed were female (C1 and C3). They both indicated many times that they were less than confident of their computing skills. "The stuff is really interesting. I enjoyed it, but felt I was dealing more with the technology . . . will it work?" (C3) "Today was a disaster! It took me an hour to figure out how to register on ClassNet. Talk about vague directions." (C1)

- Instructor availability is important to all students regardless of their level of comfort with the technology. "I don't e-mail other professors. I got to know you better through e-mail—forced to talk." (C1)

- Attitude toward the subject does not seem to be effected by this medium. In fact, students who scored low on exams still rated the class as "excellent" or "better than

most" "Even with the test score I still think this is a neat way to take a college class." (C2)

- Enthusiasm is high at the outset of the semester, and with nurturing can be kept high throughout the term. "I was excited to begin. The freedom excites me. I can do it at 3 AM if I want. This is the height of customer service. The best thing college can do for you. I'm not trying to keep up with you." (C3)

- Motivation appears to be the single most important factor in predicting success in this medium. "This is a totally personal experience. I was hesitant at first—motivation? This was the first course where you got down and studied. I had my mind made up. It takes a lot of people to change my mind. I was comfortable without classmates. The course is set up to get help if you need it." (C2)

As a follow-up to this study, a quantitative study was conducted in Zoology 155, comparing the traditionally taught section to the Internet section. Two surveys were given to the students on a voluntary basis during the semester. The surveys were designed to measure study habits and attitude toward science. Survey validity and reliability was assured by using previously published surveys. In general, retention rates and final grades were comparable in the two sections, as were student attitudes toward science. While not statistically significant ($a = 0.05$), the grades in the Internet section were slightly higher than those in the traditional section. Study habits were most affected by the use of the Internet. Specifically, zero lectures were skipped by the Internet students, while those in the traditional lectures admitted to missing an average of 6–8 lectures (18–24%) over the course of the semester. Also, lecture notes prepared by the students were used more often in the traditional lecture (60–80% as compared to 0–20%) while those in the WWW section found the textbook and the Internet itself to be most useful. (40–60% for both compared to 0–20% in the traditional section). It is my contention that the slight increase in grades is due to these activities used during studying. Also, the WWW students scored higher on the comprehensive final than those in the traditional class, indicating that retention may be favorably effected by this medium (60% in the traditional section versus 66% in the WWW section). According to Clark (1983), the instructional design, and not the medium, is responsible for learning increases. This data would seem to indicate the medium does have an effect—perhaps, as Reiser (1994) indicates, it is a facilitative effect. The choice of medium opens many avenues of learning that are not available in traditional lectures.

Another quantitative study analyzed relationships between student achievement and the following variables: learning and motivational strategies, learning styles, and selected demographics. It was found that learning styles and student characteristics did not influence achievement. The strategies that correlated best with successful learning achievement over the Internet were the value and self-efficacy motivational strategies, and rehearsal and elaboration learning strategy. Use of any learning or motivational strategy by the student correlated positively with student achievement. The higher the student scored on a general use of motivational and learning strategies, the higher the student's overall achievement in the class. The results of a hierarchical regression analysis showed that use of motivational and learning strategies accounted for more than one third of student achievement.

Conclusions

Project BIO is one of the pioneers in the use of streaming media technology in on-line instruction. Ten Web courses have been developed that serve a variety of audiences both on-campus and at a distance. Initial assessment of the courses indicates that they are successful. Student performances and retention rates are good and student attitudes towards the courses are very favorable. Although our efforts have focused primarily on the development of on-line biology courses, the instructional paradigm appears to be applicable to virtually any discipline as indicated by the growing number of on-line courses that are using streaming media technology.[2] The pedagogical aspects of this type of instruction appear to be on the forefront of constructivist learning with students becoming excited and active participants in their learning.

Notes

1. CASO's Internet University, http://www.caso.com/iu/courses/category/science.html, a comprehensive list of over 2600 Internet courses (4 June, 1998).

2. See the Project BIO (http://project.bio.iastate.edu), RealNetworks (http://www.real.com) and RealEducation (http://www.realeducation.com) Web sites for more information.

References

Clark, R. E. 1983. Reconsidering research on learning from media. Review of Educational Research, 53(4), pp. 445–459.

Greene, M. 1973. Teacher as Stranger. Belmont, CA: Wadsworth.

Lincoln, Y. S. and Guba, E. G. 1985. Naturalistic inquiry. Newbury Park, CA. Sage.

Merriam, S. B. 1988. Case study research in Education. San Francisco, CA. Jossey-Bass.

Reiser, R. A. 1994. Clark' invitation to the dance: An instructional designer's response. Educational Technology Research and Development. Volume 42, Number 2, pp. 45–48.

Autobiographical Sketches

Thomas S. Ingebritsen is an Associate Professor in the Department of Zoology and Genetics. He received a Ph.D. in Biochemistry from Indiana University in 1979. He has been involved in outreach and distance education programs at Iowa State University since 1990. He is currently Director of Project BIO, an outreach program with the mission of developing and sharing biology education resources via the Internet. He developed and currently teaches an on-line biotechnology course. This was one of the first two courses from Iowa State University to be offered on the Internet. He has also participated in the development and teaching of an on-line introductory biology course for life science majors.

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